

Electrical Code Reminders for Builders and Building Inspectors



August 2017

Agenda:



What is a concrete encased electrode and why is it important?

When is a concrete encased electrode required to be connected to the electrical system grounding?

How can builders and building inspectors assist with compliance to the NEC?

What options do we have if the concrete encased electrode is not connected prior to foundation pour/fill?

Agenda continued:



How can builders and building inspectors assist with electrical working clearance and dedicated space requirements in the NEC?

Agenda continued:



**At what stage in the construction process
can the permanent electrical distribution
equipment and wiring be installed?**

**How can builders and building inspectors
assist with compliance?**

The Planet Earth

Bringing
Grounding and Bonding down
to earth.

Our goal is to
explain code
requirements
in a simple
fashion.



The Earth as a Conductor



Grounded: "Connected (connecting) to ground or to a conductive body that extends the ground connection"

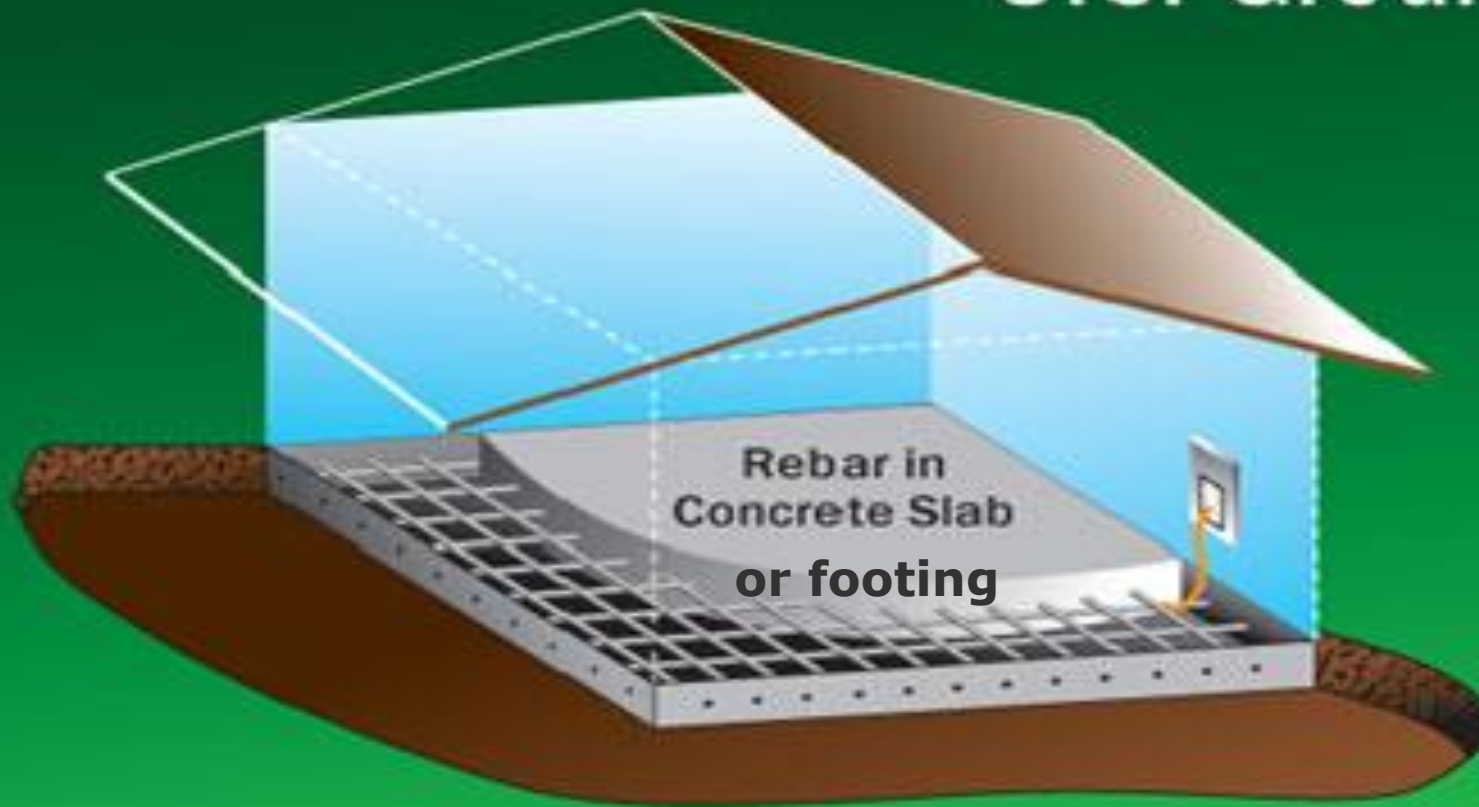


The earth as a conductor is assumed to have an electrical voltage potential of zero

What is a concrete encased electrode?



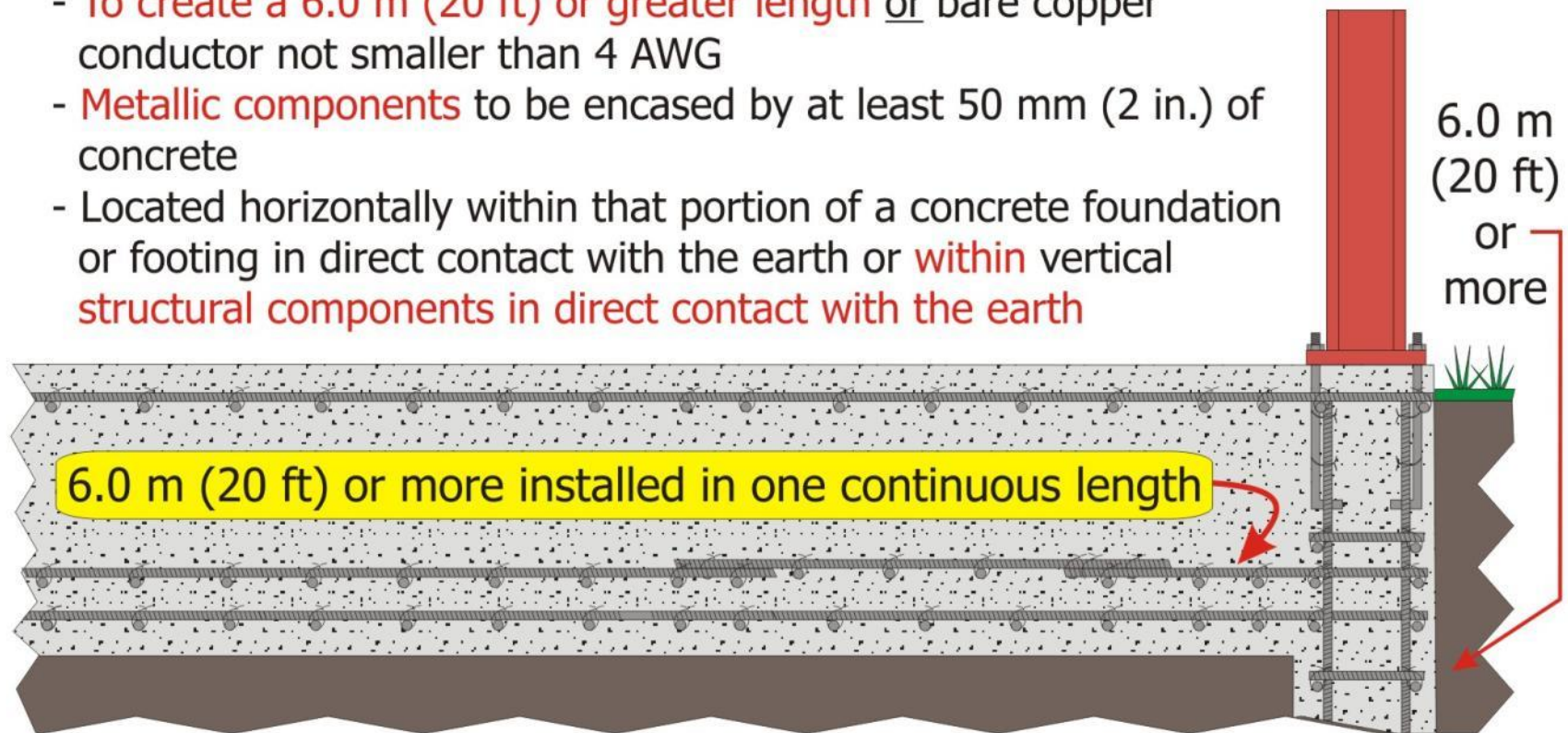
Ufer Ground



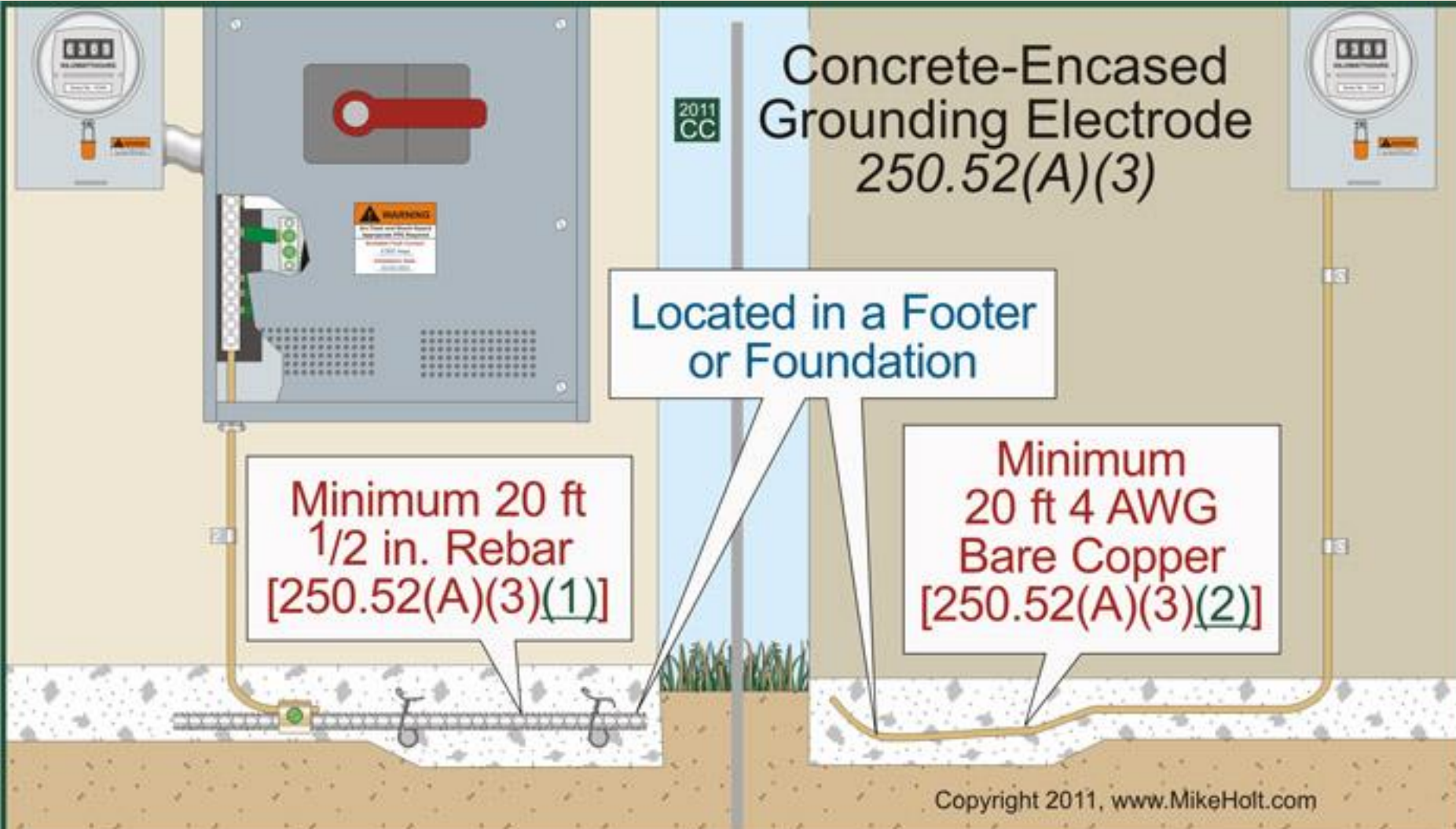
250.52(A)(3) Concrete-Encased Electrode

Concrete-encased electrode to consist of:

- At least 6.0 m (20 ft) **of either** one or more electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (1/2 in.) in diameter,
- **Installed in one continuous 6.0 m (20 ft) length, or multiple pieces connected together by the usual steel tie wires, exothermic welding, welding, etc.**
- **To create a 6.0 m (20 ft) or greater length** or bare copper conductor not smaller than 4 AWG
- **Metallic components** to be encased by at least 50 mm (2 in.) of concrete
- Located horizontally within that portion of a concrete foundation or footing in direct contact with the earth or **within vertical structural components in direct contact with the earth**

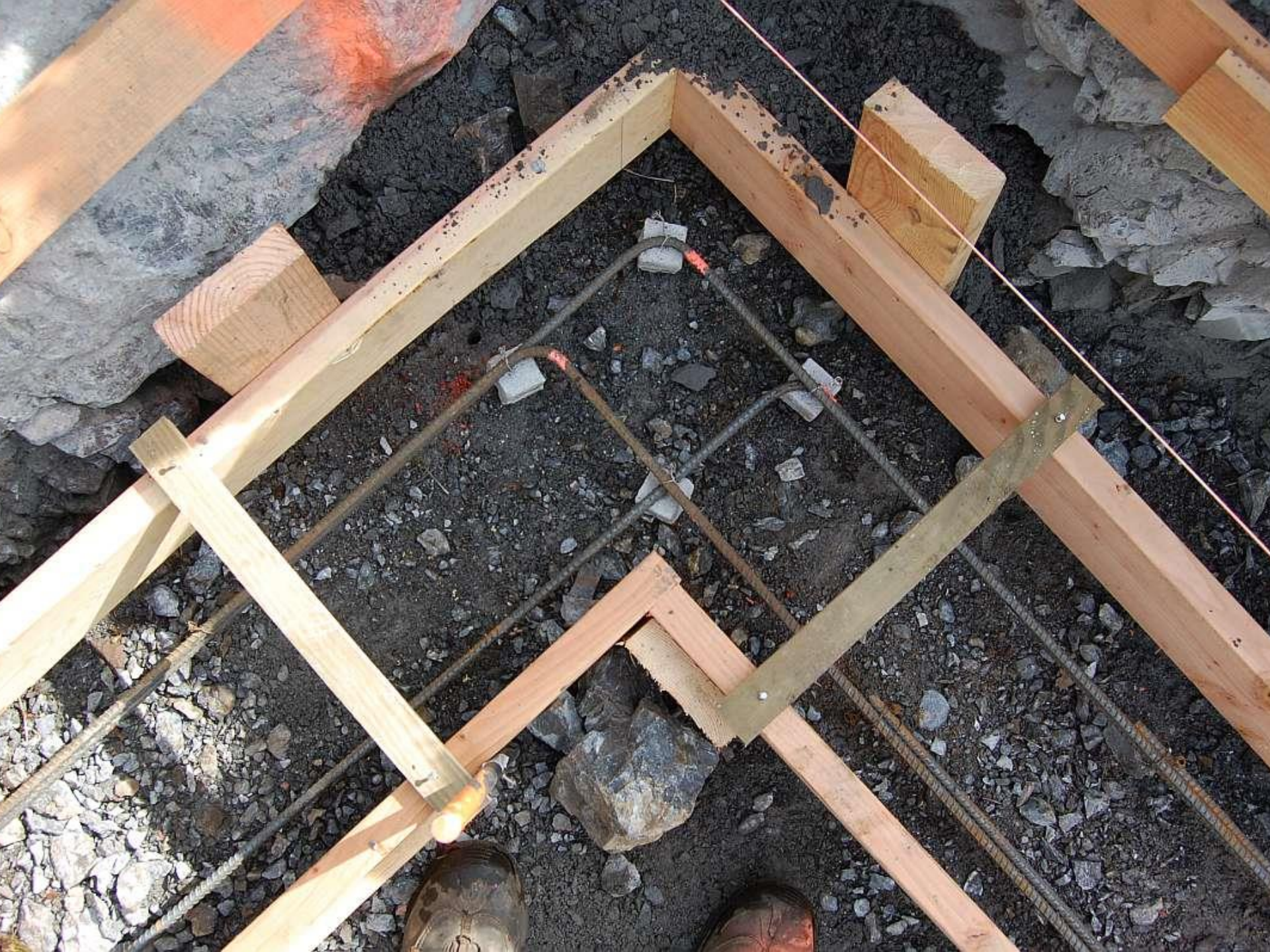


Requirements for a concrete-encased electrode to qualify as a grounding electrode has been refined for clarity



A concrete-encased electrode is an electrode that's encased by at least 2 in. of concrete, located horizontally near the bottom or vertically within a concrete foundation or footing that's in direct contact with the earth.















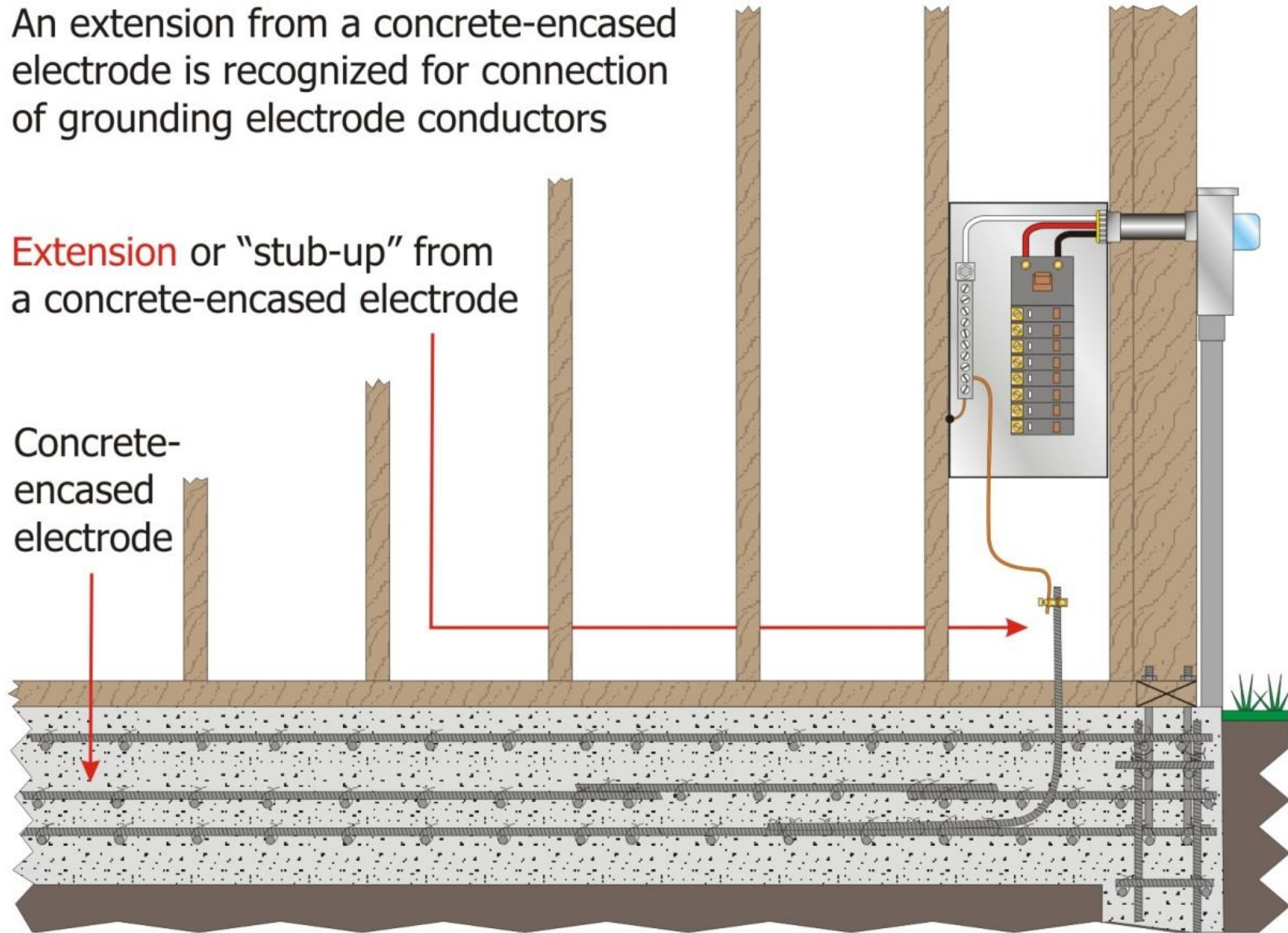
250.68(C)(3) Concrete-Encased Electrode Extension



An extension from a concrete-encased electrode is recognized for connection of grounding electrode conductors

Extension or "stub-up" from a concrete-encased electrode

Concrete-encased electrode



NEC 250.68



This practice of extending a piece of rebar (*connected to a concrete-encased electrode*) above the poured slab “inside the building” allows for construction activity to proceed in an orderly fashion and prior to an electrician required on-site.



Recommended Option.

It should be noted that the extension or “stub-up” is not part of the concrete-encased electrode (*just an extension*).





Why is a concrete encased electrode important?



Concrete-encased electrodes were developed over 50 years ago as a means of grounding ammunition bunkers in the desert and have been used in many other jurisdictions around the country for grounding electrical systems with a long history of superior performance with little or no maintenance. The soil conditions found in many areas of Wisconsin can present a significant challenge with respect to the grounding of electrical systems. The concrete encased electrode with its proven reliability in difficult soil conditions represents a superior choice for these conditions. With that being said, the mandated use is clearly in the interest of public safety.



When is a concrete encased electrode required to be connected to the electrical system grounding?

Answer: If present at a building or structure and there is direct earth contact it shall be used and connected.

No Exceptions!

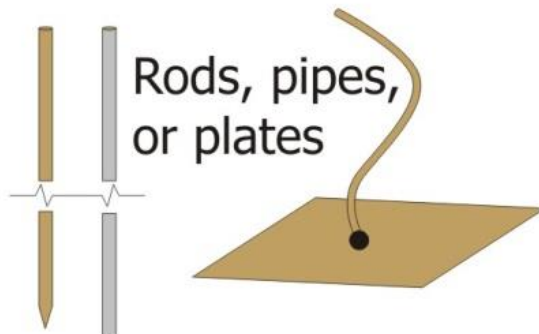
250.50 Grounding Electrode System



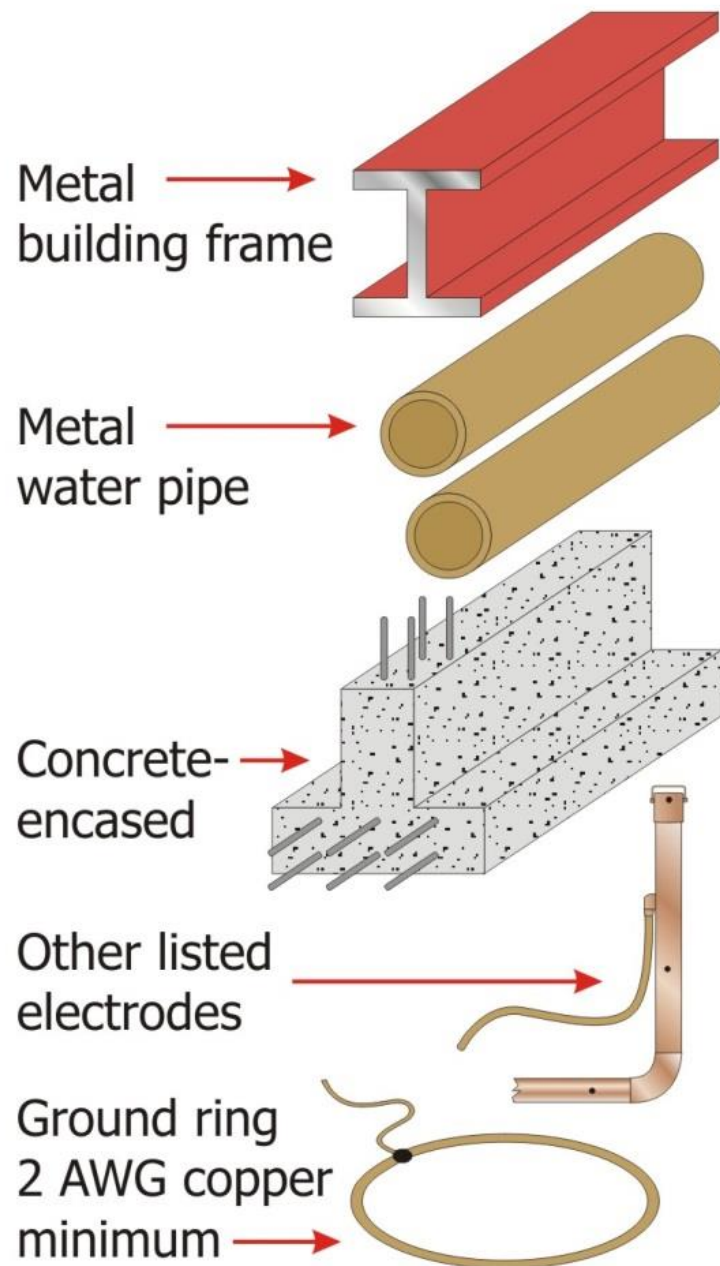
- Where present, grounding electrodes required to be used to form the grounding electrode system
- Includes electrodes that are an inherent component of the building construction (*metal structure, etc.*)
- By exception, existing concrete-encased electrodes not required to be used where doing so involves disturbing concrete footings of existing structures or buildings



Other metal structures



Rods, pipes, or plates



Metal building frame

Metal water pipe

Concrete-encased

Other listed electrodes

Ground ring
2 AWG copper
minimum

What options do we have if the concrete encased electrode is not connected prior to foundation pour/fill?



The solution permitted is to install 20' of #4 bare copper conductor or 20' of 1/2 rebar along the edge of the building foundation. The conductor or rebar shall then be encased in 2" of concrete that is poured in contact with the existing building structure. When dried, the electrode system becomes attached to the building structure or foundation, satisfying the intent of the NEC requirement.





How can builders and building inspectors assist with compliance to the NEC?

Answer: If the concrete encased electrode qualifies as a ground electrode, require a connection be made before pour or a stub-up installed in the interior of the dwelling for future connection purposes.



Questions?

How can builders and building inspectors assist with electrical working clearance and dedicated space requirements in the NEC?



What is Working Space?



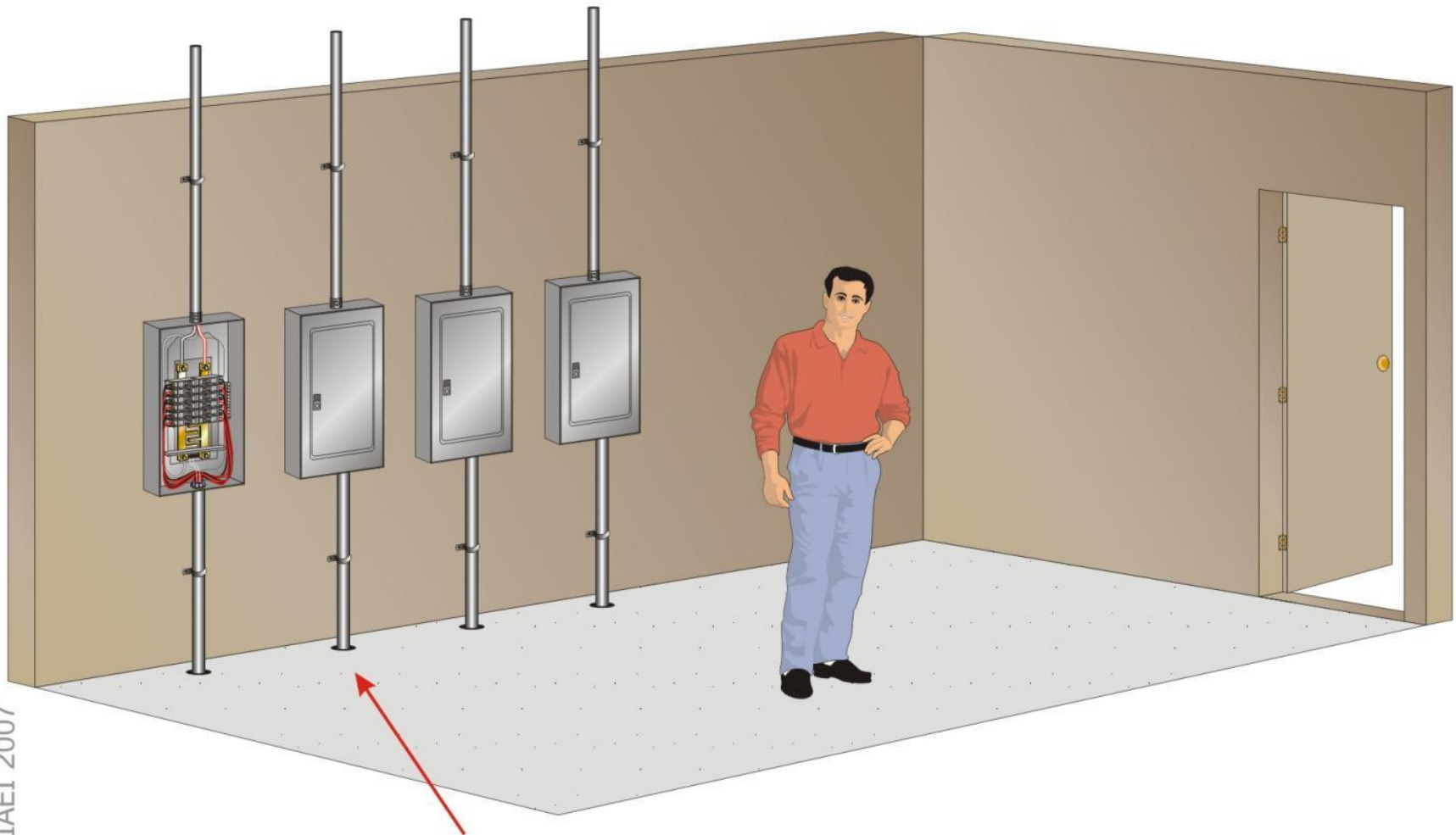
- The term is not defined in the *NEC*
- It is obvious from reading 110.26 and 110.33 that working space has three dimensions (a cube) that consists of:
 - depth (according to the table),
 - width, and
 - height
- This can be visualized as a large box, carton or crate that consists of the required dimensions
- The depth and width of the working space can be marked out on the floor in the area where working space is required



110.26 Spaces About Electrical Equipment.

- Sufficient access and working space is required to be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment
 - This is a general rule that applies to all equipment.

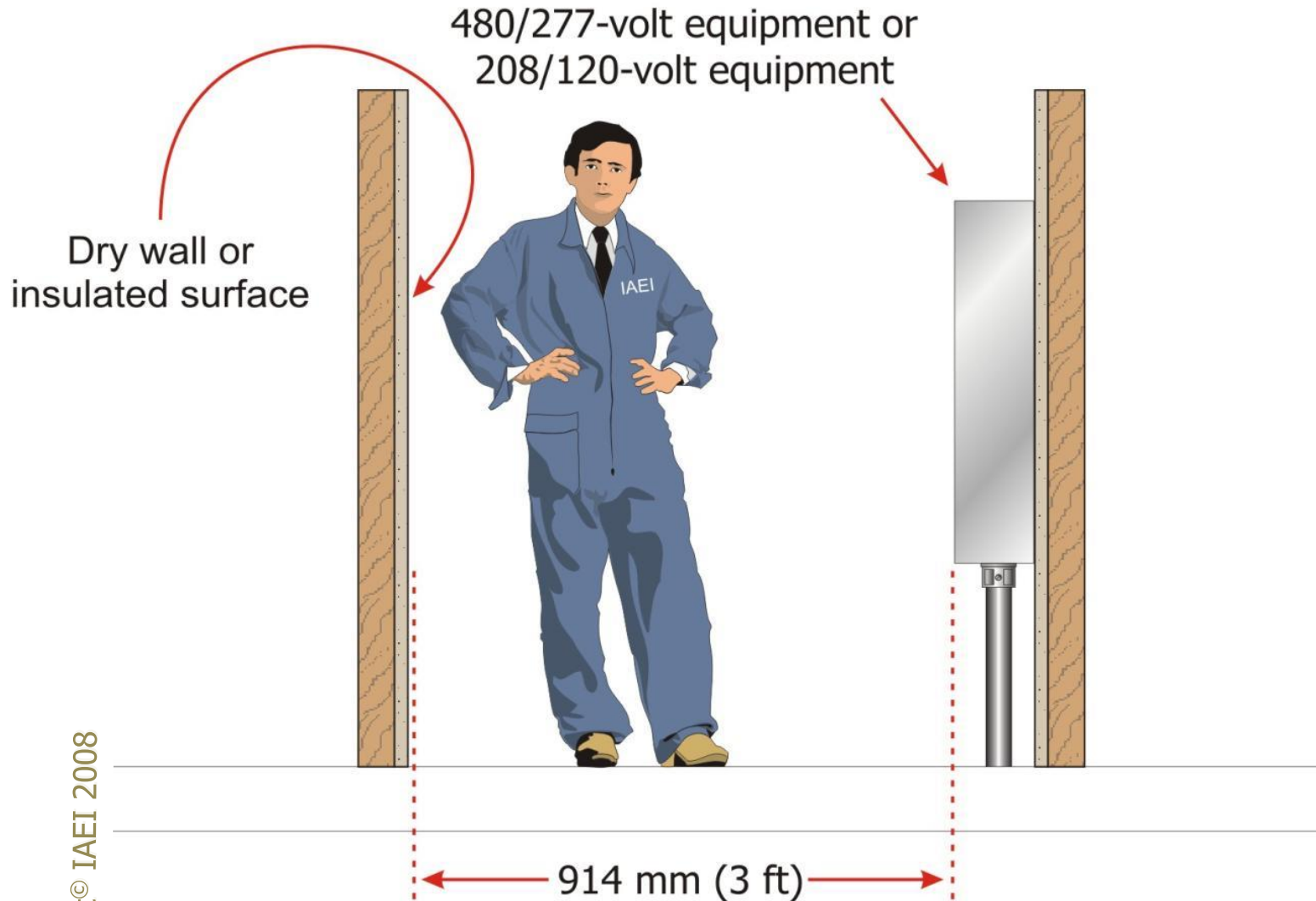
110.26 Working Spaces About Electrical Equipment



Sufficient access and working space is required to be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment.



110.26(A)(1) Condition 1



110.26(A) Condition 2



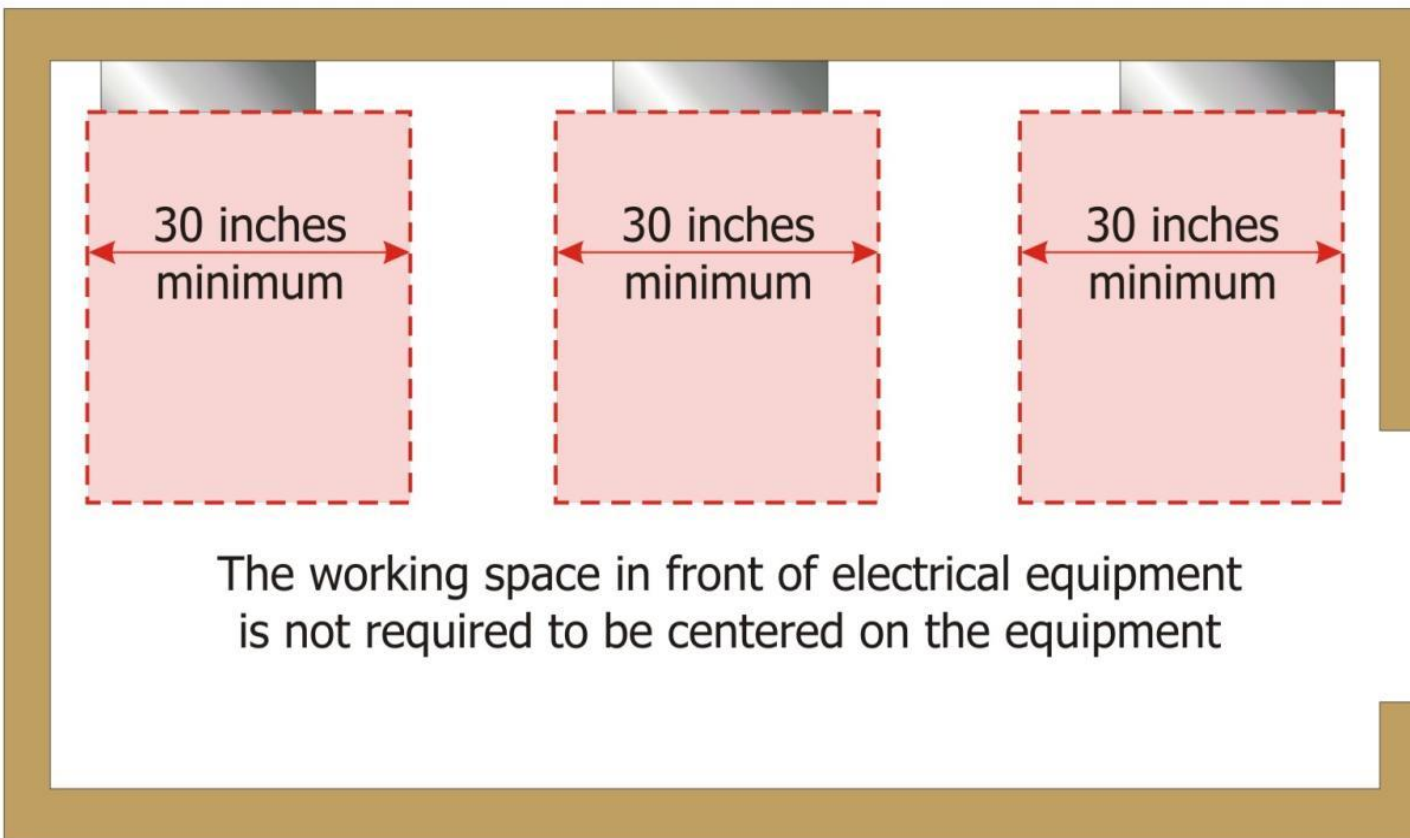
Concrete
block wall
or other
grounded
surfaces

208Y/120-volt equipment



914 mm (36 in.)

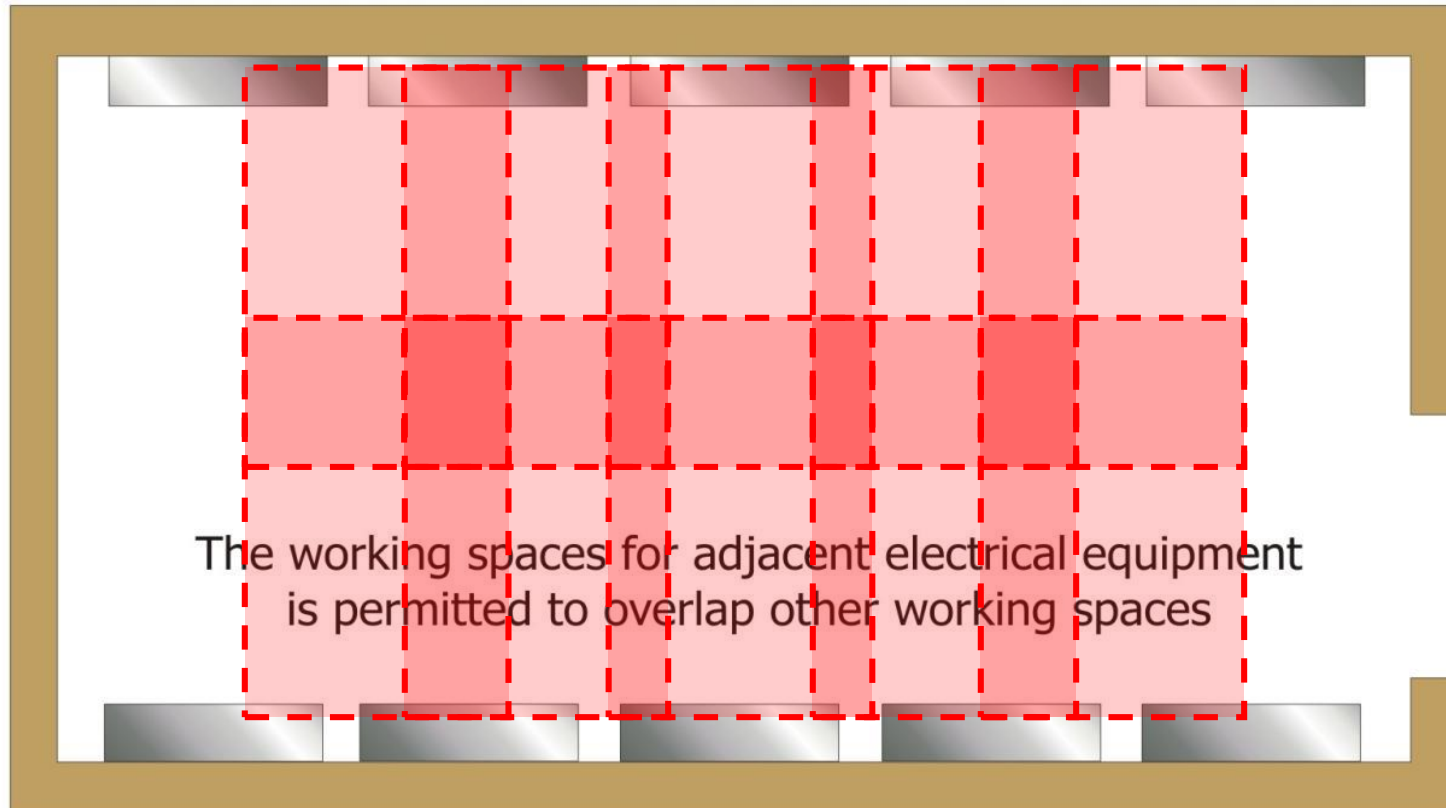
110.26(A)(2) Width of Working Space



The width of the working space in front of electrical equipment is required to be not less than the width of the equipment or 762 mm (30 in.), whichever is greater

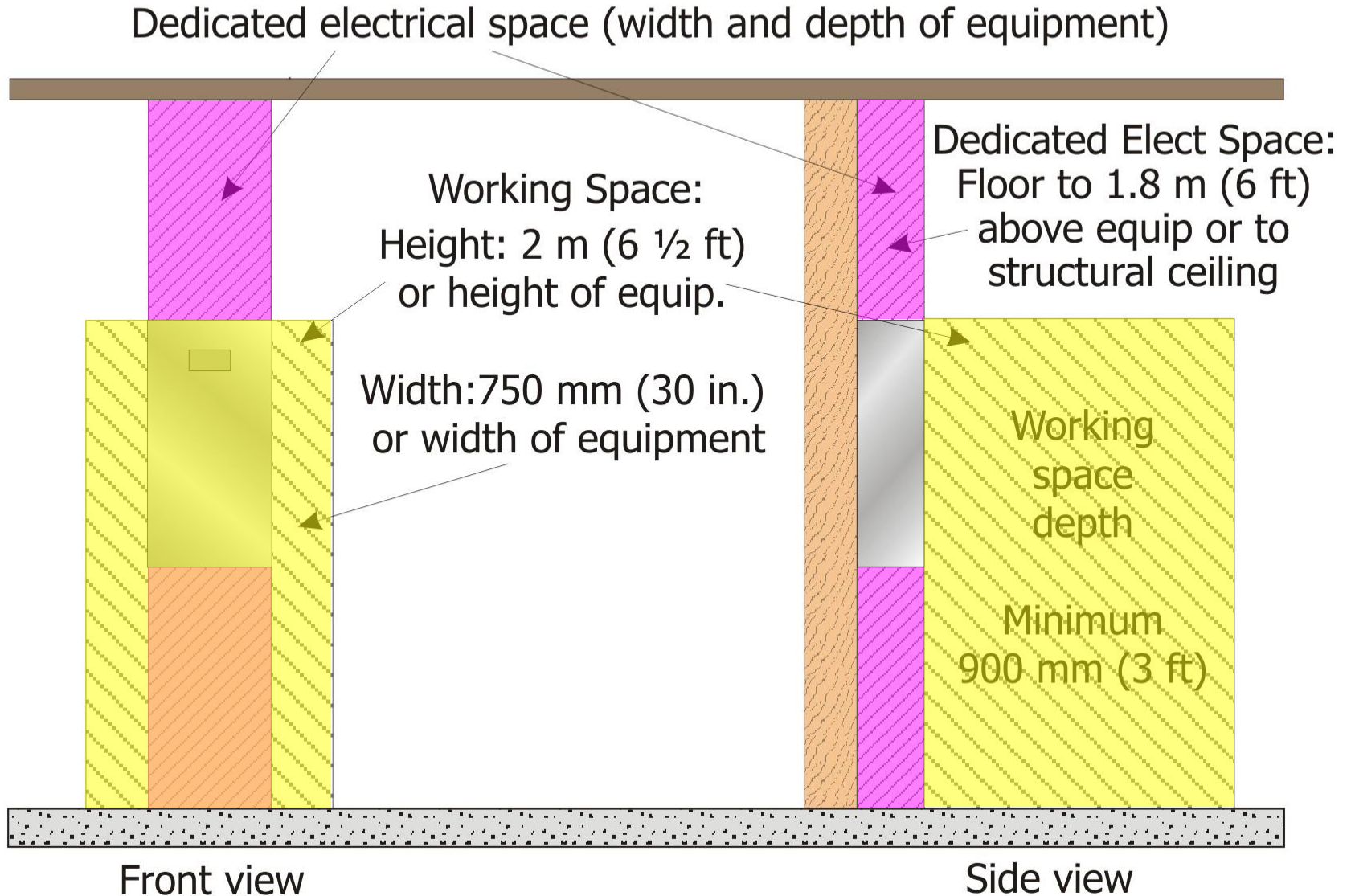


110.26(A)(2) Width of Working Space



The width of the working space in front of electrical equipment is required to be not less than the width of the equipment or 762 mm (30 in.), whichever is greater

110.26(A) Working Space Required

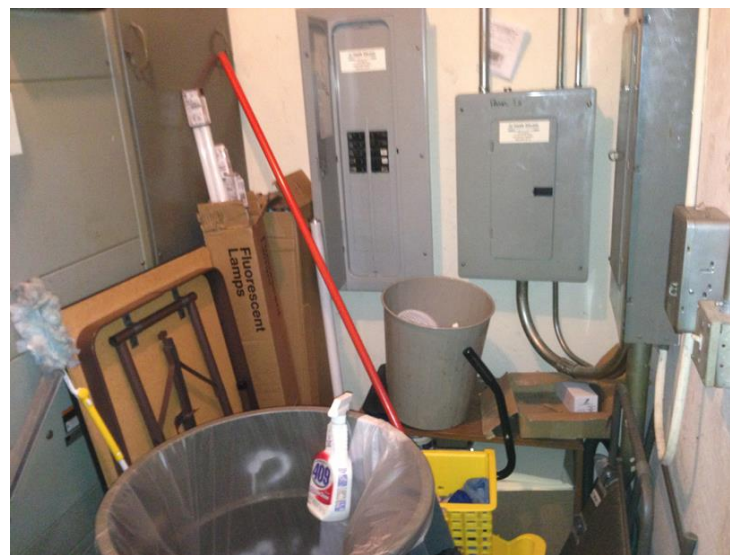




www.checkthishouse.com



5.6 Picture 2

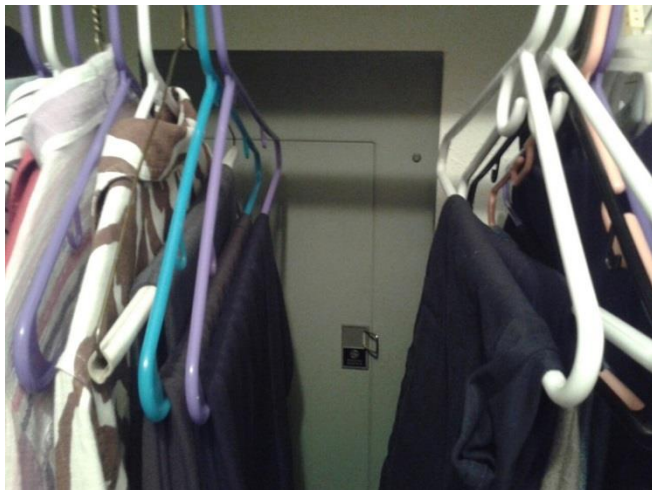


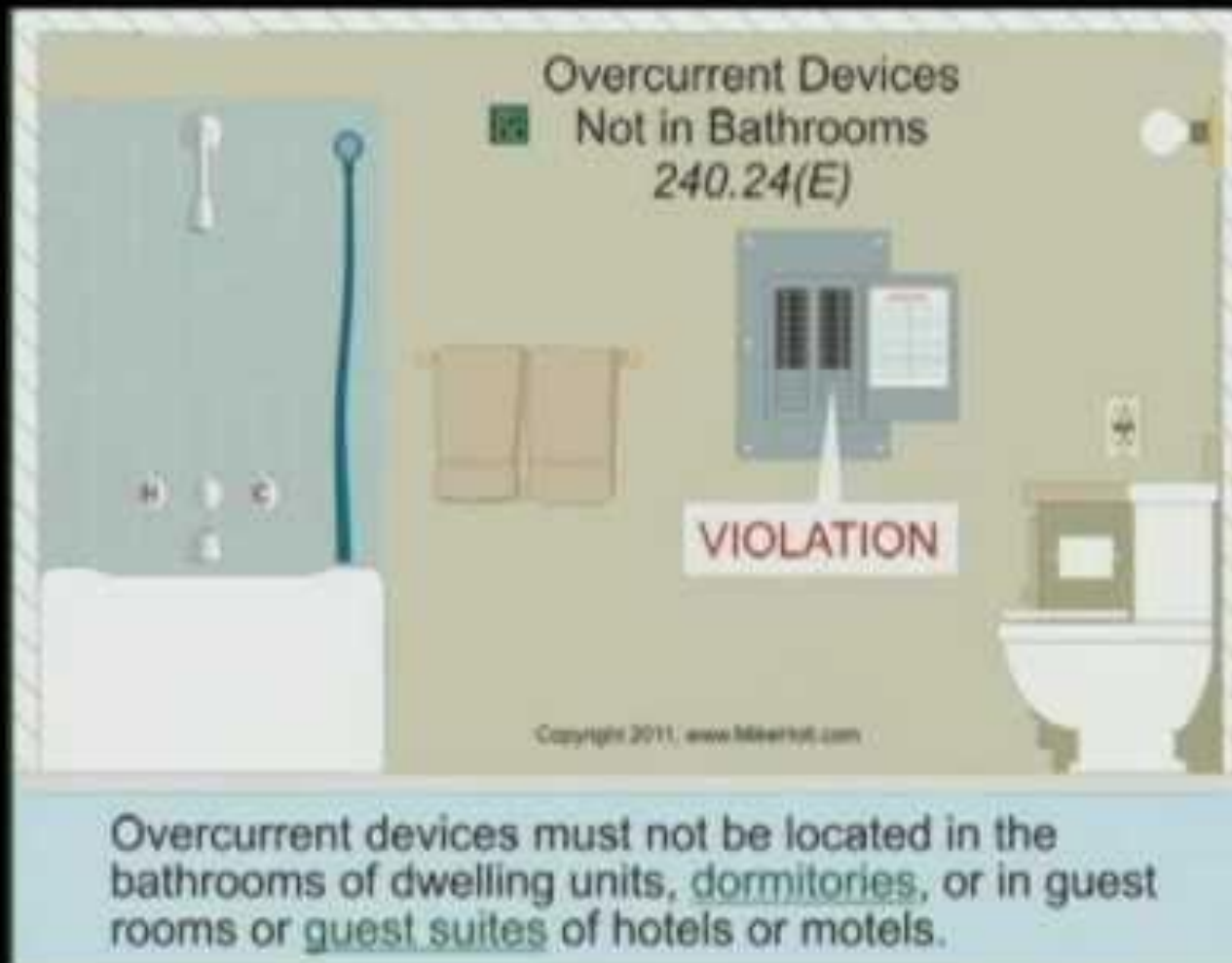
Overcurrent Devices - Easily Ignitable Material Section 240.24(D)



Overcurrent protection devices are not to be located near easily ignitable material, such as in clothes closets.

VIOLATION



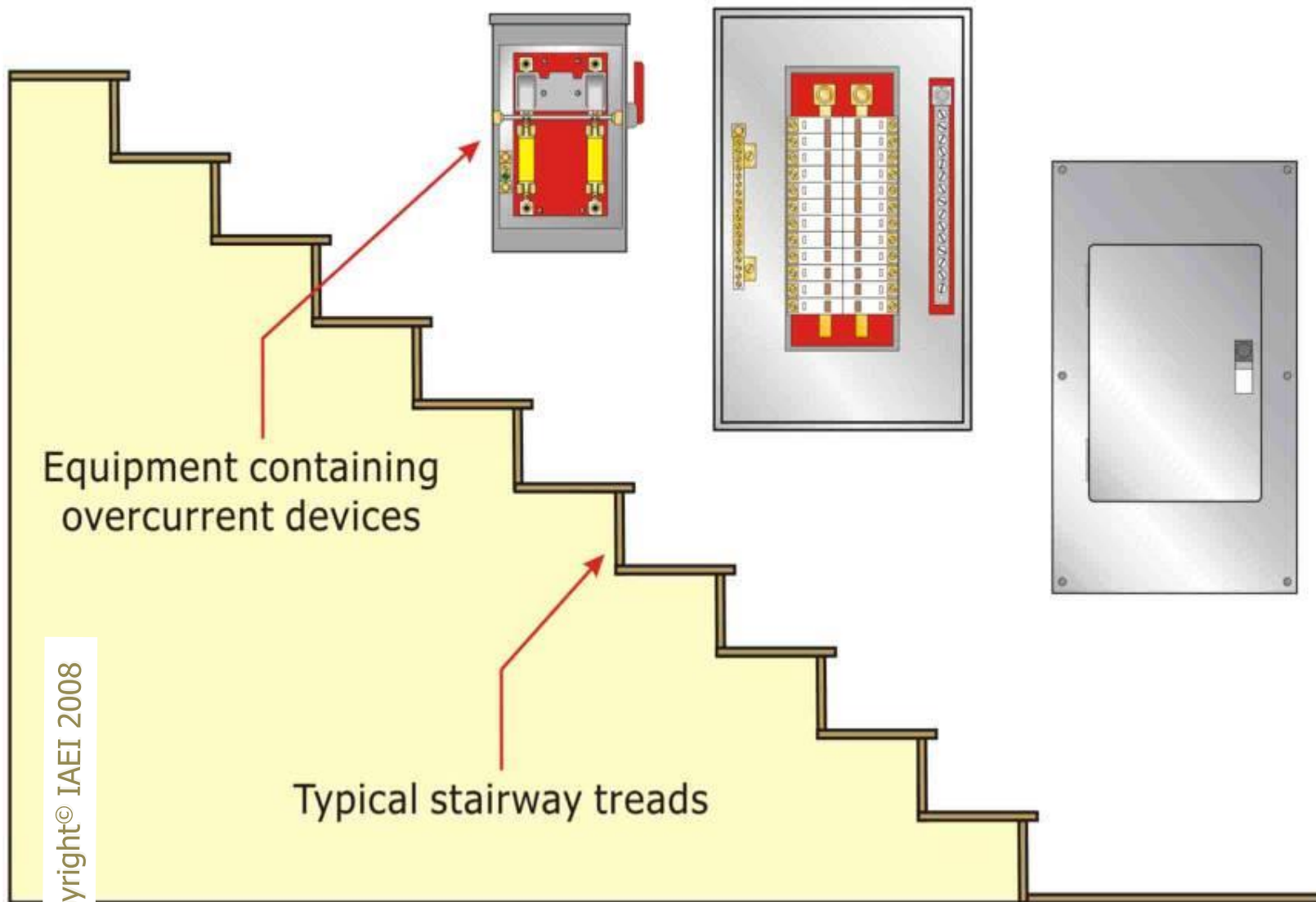




240.24(F) Not Located Over Steps

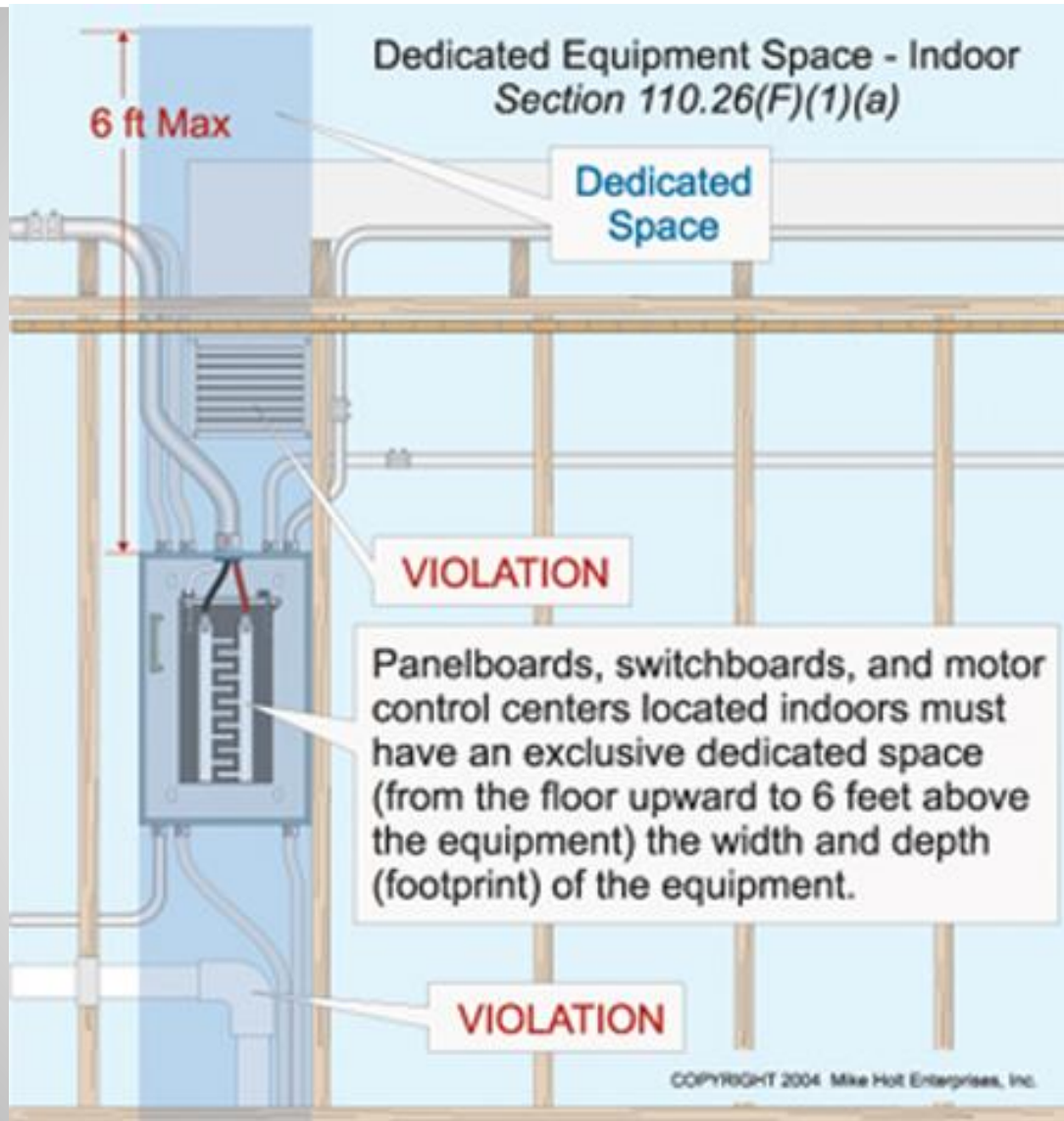


Overcurrent protective devices shall not be located over steps of a stairway.





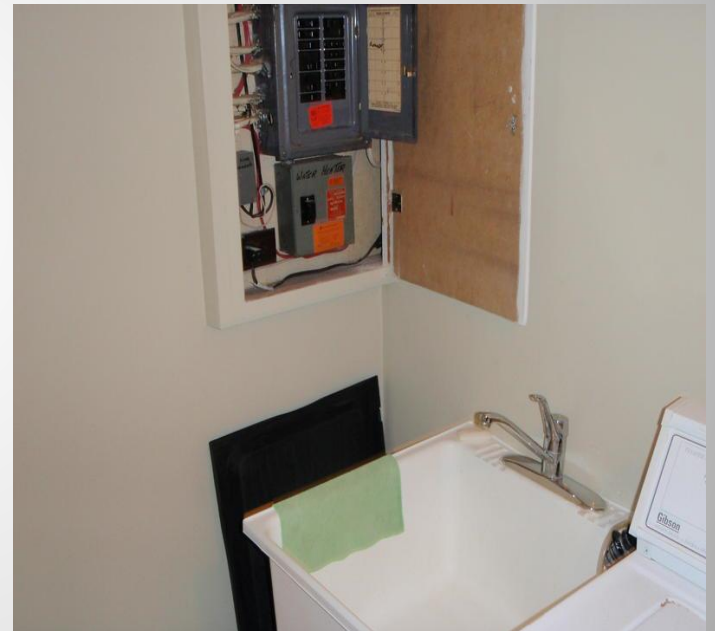
- (a) Dedicated Electrical Space. The space equal to:
 - the width and depth of the equipment, and
 - extending from the floor to a height of 1.8 m (6 ft.) above the equipment or to the structural ceiling, whichever is lower, and
 - is required to be dedicated to the electrical installation
- No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation is permitted to be located in this zone
- *Exception: Suspended ceilings with removable panels shall be permitted within the 1.8-m (6-ft) zone*







Acceptable?







- Outdoor electrical equipment is required to be installed in suitable enclosures and be protected from accidental contact by unauthorized personnel, or by vehicular traffic, or by accidental spillage or leakage from piping systems
- The working clearance space shall include the zone described in 110.26(A)
- No architectural appurtenance or other equipment shall be located in this zone

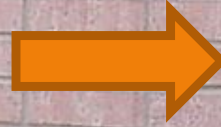
No architectural appurtenance or other equipment shall be located in this zone



D.I.Y. WOOD SCREEN *to cover eye sores*



Acceptable?





Meter Socket
Working
Clearance
Required NEC
110.26(A)



- **How can builders and building inspectors assist with compliance with NEC working clearance requirements?**

Answer: Do not permit piping, ducts, or other equipment foreign to the electrical installation in the required working space.



Questions?



- **At what stage in the construction process can the permanent electrical distribution equipment and wiring be installed?**
- **How can builders and building inspectors assist with compliance?**

Electrical equipment & wiring exposed to water can be extremely hazardous if reenergized without performing a proper evaluation and taking necessary actions. Reductions in integrity of electrical equipment due to moisture can affect the ability of the equipment to perform its intended function. Damage to electrical equipment can also result from flood waters contaminated with chemicals, sewage, oil and other debris, which will affect the integrity and performance of the equipment.





Acceptable?

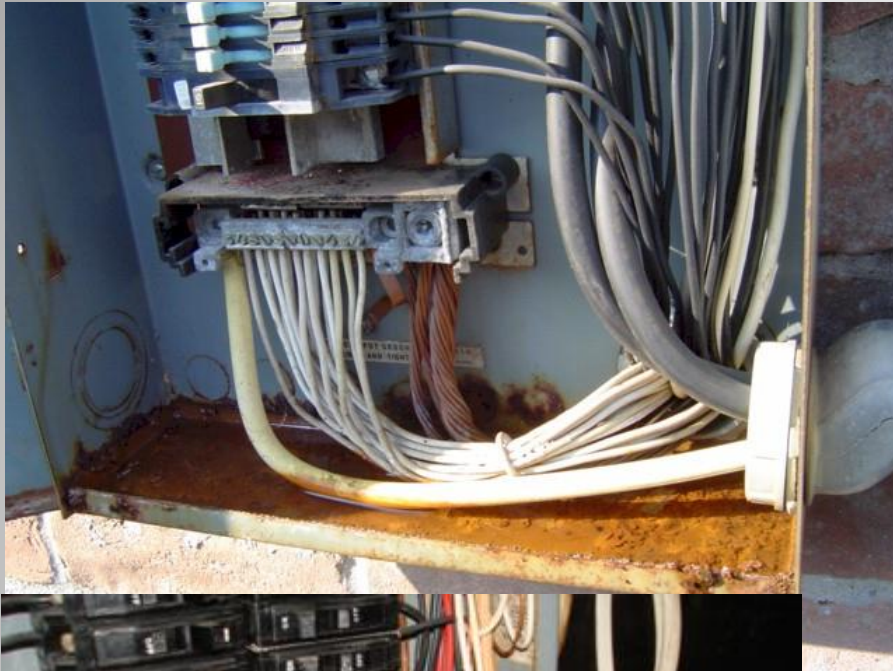




01/07/2003

Interior dry location
use electrical panel
permanently installed
on the exterior of
home.





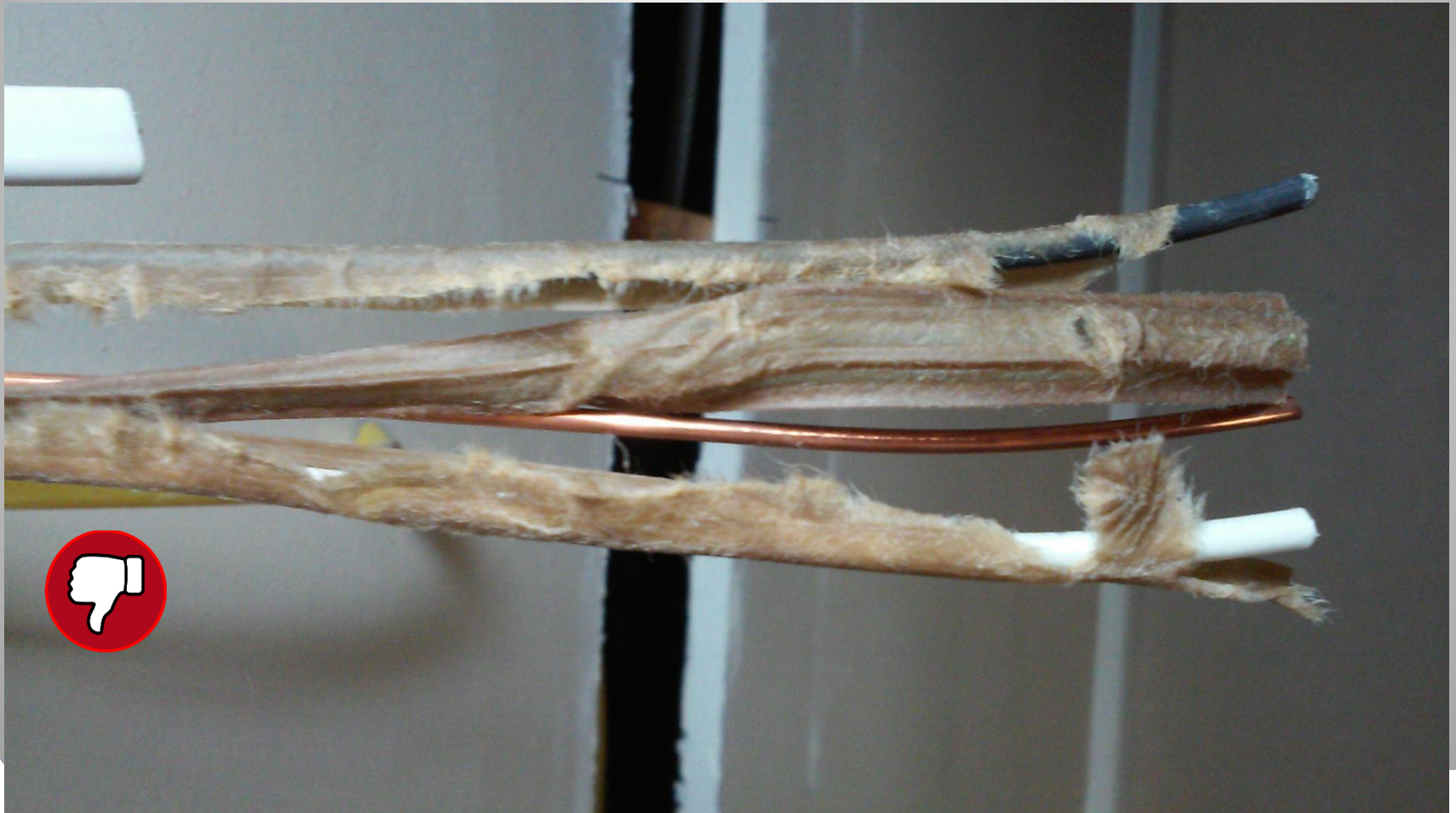
Rust in electrical
distribution box.



Working knowledge of electrical systems and of the equipment in question is required to evaluate damage due to contact with water. The original manufacturer of the equipment should be contacted if any questions arise or specific recommendations are needed. **In many cases, replacement will be necessary.**

- **110.11 Deteriorating Agents.** Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes, vapors, **liquids**, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures. Equipment not identified for outdoor use and equipment identified only for indoor use, such as “dry locations”, shall be protected against damage from the weather during construction.

NM Romex Exposed to Water



- NM cable/romex shall not be installed in wet or damp locations per NEC 334.12(B)(4).



How can builders and building inspectors assist with compliance?

Answer: Don't permit electrical wiring and dry location electrical equipment to be installed until the interior of the dwelling is water tight or until suitable arrangements are made to ensure protection from the elements.



Questions?



ELECTRICIANS

Some countries have them, others fail.

Contact Us



Electrical Questions:



DSPSSBElectrictech@wi.gov



ElectricTech Voicemail 608-264-7823



<http://dsps.wi.gov/Home>



THANK YOU